CLAIMS

[1] A mobile radio apparatus for a radio communication, comprising

an antenna;

a signal processing section for processing a signal;

a matching circuit for matching an impedance between said antenna and said signal processing section, the matching circuit being connected between said antenna and said signal processing section, and having a variable load value;

a control section for controlling the load value of said matching circuit; and

a storage section for storing information on the load value of said matching circuit as initial load value information, corresponding to a use situation of said mobile radio apparatus,

said control section includes

initial control means for evaluating said initial load value information stored in said storage section upon starting control of said matching circuit, and if there is initial load value information for providing impedance matching, for controlling said matching circuit so as to have a load value corresponding to this initial load value information; and

if there is no initial load value information for

providing the impedance matching, matched load value deriving means for deriving matched load value information which is information on the load value for providing the impedance matching, using said initial load value information stored in said storage section, and controlling said matching circuit so as to have a load value corresponding to said derived matched load value information.

[2] The mobile radio apparatus according to claim 1, further comprising a matching detecting section for detecting an impedance matching rate between said antenna and said signal processing section, the matching detecting section being connected between said matching circuit and said signal processing section, wherein

said matching detecting section includes a signal strength detecting section for detecting signal strength of a first frequency band corresponding to a frequency band of a received signal received through said antenna and said matching circuit,

said initial control means evaluates said initial load value information stored in said storage section based on the signal strength of the first frequency band detected by said signal strength detecting section, and

if there is no initial load value information for providing the impedance matching, said matched load value

deriving means, while changing the load value of said matching circuit, evaluates the changed load value of said matching circuit based on the signal strength of the first frequency band detected by said signal strength detecting section, and derives said matched load value information.

[3] The mobile radio apparatus according to claim 1, further comprising a matching detecting section for detecting the impedance matching rate between said antenna and said signal processing section, the matching detecting section being connected between said matching circuit and said signal processing section, wherein

said matching detecting section includes a reflected voltage detecting section for detecting a reflected voltage of a second frequency band corresponding to a frequency band of a transmission signal generated in said signal processing section,

said initial control means evaluates said initial load value information stored in said storage section based on the reflected voltage of the second frequency band detected by said reflected voltage detecting section,

while, if there is no initial load value information for providing the impedance matching, said matched load value deriving means, while changing the load value of said matching circuit, evaluates said changed initial load value information

based on the reflected voltage of the second frequency band detected by said reflected voltage detecting section, and derives said matched load value information.

[4] The mobile radio apparatus according to claim 1, wherein

said signal processing section transmits a function to be used to said control section, and

said control section controls the load value of said matching circuit, along with the function transmitted from said signal processing section, so that received power of the received signal received through said antenna and said matching circuit, or transmission power of the transmission signal generated in said signal processing section may be increased.

[5] The mobile radio apparatus according to claim 1, wherein said matched load value deriving means derives said matched load value information by means of repeatedly changing the load value of said matching circuit.

[6] The mobile radio apparatus according to claim 5, wherein

said initial load value information is initial information for indicating the load value of said matching circuit, and

said matched load value deriving means derives information for indicating said matched load value information by means of evolving said initial information.

[7] The mobile radio apparatus according to claim 5, wherein

said initial load value information is an initial chromosome for indicating the load value of said matching circuit, and

said matched load value deriving means derives a chromosome for indicating said matched load value information by means of evolving said initial chromosome using a genetic algorithm.

[8] The mobile radio apparatus according to claim 5, wherein said matched load value deriving means derives said matched load value information by means of finely adjusting the load value of said matching circuit using a steepest descent method algorithm.

[9] The mobile radio apparatus according to claim 5, wherein

said matching circuit includes a plurality of switches for selecting a load, and

said matched load value deriving means derives, while

switching said plurality of switches, said matched load value information which is information on on/off of the switch by setting a state where said plurality of switches are controlled to a starting point, so as to correspond to the initial load value information with the highest evaluation.

[10] The mobile radio apparatus according to claim 1,

wherein said matched load value deriving means includes

local search means for deriving said matched load value information by means of finely adjusting the load value of said matching circuit, and

if said matched load value information cannot be derived by means of said local search means, global search means for newly generating load value information required for deriving said matched load value information, and deriving said matched load value information using said load value information, and

wherein if said matched load value information cannot be derived by said global search means, said local search means derives said matched load value information by means of finely adjusting the load value of said matching circuit again.

[11] The mobile radio apparatus according to claim 1, wherein said matched load value deriving means derives said

matched load value information by means of finely adjusting the load value of said matching circuit.

[12] The mobile radio apparatus according to claim 1, wherein said matched load value deriving means generates pieces of information for indicating the load values of the matching circuit at random as the random load value information to thereby evaluate said generated random load value information, and

if there is random load value information for providing the impedance matching, controls said matching circuit so as to have the load value corresponding to said random load value information,

while, if there is not said random load value information for providing the impedance matching, derives said matched load value information using said initial load value information and said random load value information.

[13] The mobile radio apparatus according to claim 12, wherein

said initial load value information is an initial chromosome for indicating the load value of said matching circuit,

said random load value information is a random chromosome for indicating the load value of said matching

circuit, and

said matched load value deriving means derives said matched load value information by means of evolving said initial chromosome and said random chromosome using a genetic algorithm.

[14] The mobile radio apparatus according to claim 13, wherein said matched load value deriving means derives said matched load value information by means of finely adjusting the load value of said matching circuit corresponding to a chromosome with the highest evaluation among the chromosomes obtained by means of evolving said initial chromosome and said random chromosome.

[15] The mobile radio apparatus according to claim 14, wherein if the processing for fine adjustment satisfies a predetermined limiting condition, said matched load value deriving means generates a new chromosome, and derives said matched load value information using said new chromosome that has been generated.

[16] The mobile radio apparatus according to claim 15, wherein said matched load value deriving means evaluates said new chromosome, and

if there is a chromosome for providing the impedance

matching, controls said matching circuit to have the load value corresponding to said chromosome,

while, if there is not said chromosome for providing the impedance matching, evolves said new chromosome using a genetic algorithm to derive said matched load value information using the evolved chromosome.

[17] The mobile radio apparatus according to claim 16, wherein said matched load value deriving means derives said matched load value information by means of finely adjusting the load value of said matching circuit corresponding to the chromosome with the highest evaluation among the chromosomes obtained by means of evolving said new chromosome.

[18] The mobile radio apparatus according to claim 1, wherein

said control section further comprises new initial load value information registration means for additionally registering said matched load value information derived by said matched load value deriving means to said storage section as the initial load value information, and

said control section performs control from the next time using the initial load value information which is newly additionally registered.

[19] The mobile radio apparatus according to claim 1, wherein

said mobile radio apparatus is a mobile phone, and

said initial load value information includes

information on a load value expected to provide the impedance matching in a situation when there is said mobile phone in a free space apart from a human body,

information on a load value expected to provide the impedance matching when said mobile phone is used in a situation during call, and

information on a load value expected to provide the impedance matching in a situation when a mail function of said mobile phone is used.

[20] The mobile radio apparatus according to claim 1, further comprising a matching detecting section for detecting the impedance matching rate, the matching detecting section being connected between said matching circuit and said signal processing section,

wherein said control section determines whether or not the impedance matching is obtained, based on the detected result by said matching detecting section.

[21] The mobile radio apparatus according to claim 20, wherein said initial control means starts the control of said

matching circuit based on the detected result by said matching detecting section.

[22] The mobile radio apparatus according to claim 20, wherein

said matching detecting section detects a reflected voltage or a received power,

said mobile radio apparatus further comprises an integrating circuit, and

the reflected voltage or the received power detected by said matching detecting section is inputted into said control section through said integrating circuit.

[23] The mobile radio apparatus according to claim 1, further comprising a use situation change detecting section for detecting the change of the use situation of said mobile radio apparatus,

wherein said initial control means starts the control of said matching circuit when the change of the use situation is detected by said use situation change detecting section.

[24] The mobile radio apparatus according to claim 23, wherein said initial control means first evaluates the initial load value information corresponding to the use situation after the change detected by said use situation change detecting

section.

[25] The mobile radio apparatus according to claim 24, wherein

said mobile radio apparatus is a mobile phone,

said use situation change detecting section detects whether or not the use situation is in a talk state by means of detecting whether or not a call button of said mobile phone is pressed, and

if the use situation is detected to be in the talk state by said use situation change detecting section, said initial control means first evaluates the initial load value information corresponding to the talk state.

[26] The mobile radio apparatus according to claim 24, wherein

said mobile radio apparatus is a flip mobile phone,

said use situation change detecting section detects whether or not the use situation is in an open state or in a close state by means of detecting open/close of said flip mobile phone, and

said initial control means, if the open state is detected by said use situation change detecting section, first evaluates the initial load value information corresponding to the open state, while, if the use situation is detected to be

in the close state by said use situation change detecting section, first evaluates the initial load value information corresponding to the close state.

[27] The mobile radio apparatus according to claim 24, wherein

said use situation change detecting section detects the change of the use situation of said mobile radio apparatus by detecting a temperature, and

said initial control means first evaluates the initial load value information corresponding to the temperature detected by said use situation change detecting section.

[28] The mobile radio apparatus according to claim 1, further comprising

at least one other antenna other than said antenna, and

a switch circuit for switching a connection between said signal processing section, and said antenna and said other antenna, wherein

said matching circuit matches the impedance between said antenna and said other antenna, and said signal processing section, and

said control section controls the connection of said

switch circuit.

[29] The mobile radio apparatus according to claim 1, wherein said matching circuit includes

at least one reactive element and/or at least one inductance element, which serves as the load, and

at least one switch for selecting said load.

[30] The mobile radio apparatus according to claim 28, wherein said at least one switch is a MEMS (Micro-Electro-Mechanical System) switch.